said electrode layer being capable of passing an emitted light;

said electrode pad being capable of supplying a current to said electrode layer; and

wherein said second metal layer is made of gold (Au), said first metal layer comprises a material that has an ionization potential lower than gold (Au), and said third metal layer comprises [a material] aluminum (Al) that has an adhesiveness to said protection film which is stronger than gold (Au).

5. (Amended) An electrode pad according to claim 1, wherein said material of said first metal layer is nickel (Ni) [and said material of said third metal layer is aluminum (Al)].

REMARKS

Reconsideration and allowance in view of the foregoing amendments and the following remarks are respectfully requested. Currently, claims 1-2 and 4-21 are pending in this application. However, claims 15-19 have been withdrawn from consideration.

Rejection Under 35 U.S.C. §103

Claims 1-11 and 20 were rejected under 35 U.S.C. §103(a) as being unpatentable over Nakamura et al. (U.S. '422) in view of Manabe et al. (U.S. '120) and Nakamura et al. (U.S. '350). Applicant respectfully traverses this rejection with respect to still pending claims 1-2, 4-11 and 20.

In order to establish a prima facie case of obviousness, all of the claimed limitations must be taught or suggested by the prior art and there must be some suggestion or motivation, either in the references themselves or in the knowledge

generally available to one of ordinary skill in the art, to modify the reference or to combine the reference teachings.

Applicant respectfully submits that the combination of Nakamura et al. (U.S. '422) , Manabe et al. and Nakamura et al. (U.S. '350) fails to teach or suggest all of the claimed limitations. In particular, the combination fails to teach or suggest an electrode pad having a three layer structure, wherein the lowest layer (a first metal layer) is formed by a metal which has an ionization potential lower than gold, a middle layer (a second metal layer) is formed of gold, and an upper layer (a third metal layer) formed of aluminum which has an adhesiveness to a protection film which is stronger than that of gold.

The Office Action states:

> "Applicant argues that neither Nakamura references shows a three layer structure, which is true, but Manabe is relied upon to teach the third layer. Applicant also attempts to distinguish an electrode pad and an electrode with the difference depending only upon the relative placement of the layers, thus calling the lower NiAu layer the electrode and calling the upper AuNi layers the pad." (See Section 9 of the Office Action).

By this amendment, Applicant has clarified the difference between an electrode layer and the electrode pad. Thus, the difference between the electrode layer and the electrode pad is not merely the relative placement of the layers as apparently alleged by the Examiner. Accordingly, while Manabe et al. discloses an electrode layer having two layers made of nickel and aluminum, Manabe does not disclose an "electrode pad" as defined by the specification and claims or a protective film which covers a third metal layer (an Al layer) which has an adhesiveness to the protection film which is stronger than gold. Specifically, while Manabe et al. discloses using aluminum (Al) to form a portion of a multi-layer having more than three layers, Manabe fails to disclose or suggest a third layer, placed at the top of the

three layers on the electrode layer, being made of aluminum and the third layer being covered by a protective film.

The Office Action also states that, "Manabe et al. show the use of Al in a multilayer being electrode stack (See Fig. 6 and column 5, line 38) which has improved operating characteristics." Applicant respectfully notes, however, that the electrode 70 and Figs. 6-7 of Manabe et al. is an electrode layer, not an electrode pad as required by the claimed invention. As noted above, the difference between the electrode layer and the electrode pad is not merely a matter of relative order as apparently alleged by the Examiner. Therefore, Manabe et al. fails to resolve the deficiencies of Nakamura et al. (U.S. '422 and '350) with respect to the claimed electrode pad. Since Manabe et al. describes an electrode layer, not an electrode pad, one of ordinary skill in the art would clearly not have been motivated to modify the electrode pad of Nakamura et al. (U.S. '422 and '350) to provide the claimed electrode pad from the teachings of Manabe et al. Moreover, providing an Al layer as taught by Manabe et al. into the structure of Nakamura et al., would clearly contradict the teachings of Nakamura et al., which as indicated by the Office Action, teaches against the use of Al (See section 6 of the Office Action).

With respect to claims 6-9, the Office Action states, "Applicant states that none of the references show the Ni Au reversal but note that Nakamura ('422) shows the layer sequence of Ni and Au with a partial covering of NiAu and further showing an annealing at greater than 400°C (Column 5, line 55). Thus, with identical structure and identical processing, identical results will be obtained." (See section 10 of the Office Action). For the reasons discussed below and with reference to Appendix I, Applicant respectfully disagrees with the Office Action's assertion that identical processing and results are obtained by Nakamura.

An inverse distribution of nickel (Ni) and gold (Au) was examined under the condition of:

A: a heat treatment in the atmosphere whereby oxygen (O_2) exists (shown by Figs. A-1, A-2L, and A-2S of Appendix I),
B: no heat treatment (shown by Fig. A-3 of Appendix I), and
C: a heat treatment in the atmosphere where no oxygen (O_2) exists (shown by Figs. A4 and A5 of Appendix I).

Analyzing the distribution in the depth direction shown in Figs. A-1, A-2L, and A-2S, nickel (Ni) and gold (Au) is inverted and nickel (Ni) comes out on the surface.

When a heat treatment is not carried out or when a heat treatment in the atmosphere where no oxygen (O_2) exists is carried out, no transfer of nickel (Ni) and gold (Au) can be observed.

Nakamura does not disclose a heat treatment in the atmosphere where oxygen (O_2) exists. Thus, the inverse distribution of nickel (Ni) and gold (Au) shown in the present invention would not have been obvious to one of ordinary skill in the art from the teachings of Nakamura.

The Office Action points out that because the heating in the present invention is same as that of Nakamura, an inversion of nickel (Ni) and gold (Au) may also be observed in Nakamura. But the invention of two elements cannot occur in an atmosphere where no oxygen (O_2) exists. Because the heating shown by Nakamura is not carried out in an atmosphere where (O_2) exists, the claimed invention would not have been obvious from the disclosure of Nakamura. Applicant submits that it is not common to use oxygen (O_2) as one of the element of the atmosphere when a heat treatment is carried out. However, the inventors of the present invention did use oxygen (O_2) to invert the distributions of nickel (Ni) and gold (Au).

The first electrode layer made of, for example, nickel (Ni), which has a high adhesion to a semiconductor layer, is formed. The second electrode layer made of gold (Au), which has a low contact resistance to a semiconductor layer, is formed on the first electrode layer. Then a heat treatment is carried out on the electrode having the first and second electrode layers in the atmosphere where oxygen (O_2) exists. By the heat treatment, the first and the second electrode layers are inverted, and the first electrode layer made of nickel (Ni) is placed on the second electrode layer made of gold (Au), which contacts the semiconductor layer.

Accordingly, the layer made of gold (Au) is placed directly on a semiconductor layer, and the adhesion between the electrode and the semiconductor layer is ensured. Also, a driving voltage can be lowered. Here, nickel (Ni) is placed between gold (Au) and p-GaN and functions to bond the metals. Because nickel (Ni) is only to bond the metals in the present invention, its amount should be relatively small.

Accordingly, Applicant respectfully submits that claims 1-2, 4-11 and 20 are not obvious over Nakamura (U.S. '422 and '350) and Manabe et al. and respectfully request that the rejection of these claims under 35 U.S.C. §103 be withdrawn.

Rejection Under 35 U.S.C. §102(e)

Claims 12-14 and 21 were rejected under 35 U.S.C. §102(e) as being anticipated by Nakamura et al. (U.S. '422). Applicant respectfully traverses this rejection.

For a reference to anticipate a claim, each element of the claim, must be found, either expressly or under a principal of inherency, in the reference.

Applicant respectfully submits that Nakamura et al. (U.S. '422) fails to disclose each element of the claimed invention. In particular, Nakamura et al. (U.S. '422) fails to disclose the following claimed limitation:

> "The portion of said material of said second electrode layer which is uncovered by said electrode pad is distributed more deeply into said surface layer than that of said first electrode layer by heat treatment and provides a contact resistance between said electrode layer and said surface layer lower than said portion covered with said electrode pad."

The present invention is characterized by an electrode layer which is positioned underneath an electrode pad. The electrode layer has a larger resistivity under the electrode pad as compared to another portion where the pad does not exist. Because of the resistivity of this structure, electric current cannot pass through the p-type semiconductor right under the pad. Accordingly, electric current passes through only a portion which emitted light can pass through so as to improve the ratio of a luminous strength to a current intensity.

Applicant respectfully submits that the inversion of nickel and gold cannot occur beneath the electrode pad. Accordingly, a contact resistance between a p-layer and the electrode layer becomes larger and the electric current does not flow beneath the electrode pad. In Nakamura, a contact resistance between a p-layer and the electrode layer is uniform. Thus, the electrode current flows uniformly in a downward direction.

Conclusion

All objections and rejections having been addressed, Applicant believes that claims 1-2, 4-14 and 20-21 in this application are in condition for allowance and respectfully requests a notice to this effect. If the Examiner has any questions or

believes that an interview would further prosecution of this application, the Examiner is invited to telephone the undersigned.

Respectfully submitted,

Pillsbury Madison & Sutro, LLP

By: _____

Peter W. Gowdey
Reg. No. 25,872
Tel. No. (202) 861-3078
Fax No. (202) 822-0944

PWG/RYM

1100 New York Avenue, NW
Ninth Floor, East Tower
Washington, DC 20005-3918